
EXECUTIVE SUMMARY

This quarterly groundwater monitoring report presents the results of the Fourth Quarter 2016 groundwater sampling event, conducted on October 17–19 and 25, 2016, at the Red Hill Bulk Fuel Storage Facility (“the Facility”), Joint Base Pearl Harbor-Hickam (JBPHH), Hawai‘i. The Facility is located in Hālawā Heights on the island of O‘ahu. There are 18 active and 2 inactive underground fuel storage tanks located at the Facility. The State of Hawai‘i Department of Health (DOH) Facility Identification (ID) number is 9-102271. The DOH Release ID numbers are 990051, 010011, 020028, and 140010.

The groundwater sampling was conducted as part of the Red Hill groundwater long-term monitoring (LTM) program, and performed under the Comprehensive Long-Term Environmental Action Navy (CLEAN) IV contract task order 0053. Data collected for this groundwater monitoring event also support Sections 6 and 7 of the *Administrative Order on Consent in the Matter of Red Hill Bulk Fuel Storage Facility, EPA Docket Number RCRA 7003-R9-2015-01 and DOH Docket Number 15-UST-EA-01*, Attachment A, Statement of Work (EPA Region 9 and DOH 2015). The purpose of the sampling is to assess the condition of groundwater beneath the Facility, and to ensure the United States Department of the Navy (DON; Navy) remains in compliance with DOH Underground Storage Tank (UST) release response requirements as described in Hawai‘i Administrative Rules Chapter 11-281 Subchapter 7, Release Response Action. The sampling was conducted in accordance with the Naval Facilities Engineering Command (NAVFAC) Pacific *Project Procedures Manual* (DON 2015b), the DOH *Technical Guidance Manual for the Implementation of the Hawaii State Contingency Plan* (DOH 2016b), and the project work plan (WP) (DON 2015c). A forthcoming *Sampling and Analysis Plan* (SAP) is being prepared for Administrative Order on Consent (AOC) Statement of Work Sections 6 and 7 that will update information for the groundwater sampling.

This report presents the activities conducted and sampling results for wells located both inside and outside the tunnels to combine the information into one report, facilitate review, and provide a better understanding of the entire site in one document.

On October 17–19 and 25, 2016, AECOM Technical Services, Inc. (AECOM) personnel collected groundwater samples from 11 monitoring wells in the Red Hill groundwater monitoring network (wells RHMW01 to RHMW09, HDMW2253-03, and OWDFMW01) and one sampling point at Red Hill Shaft (RHMW2254-01) for the Fourth Quarter 2016 groundwater monitoring event. One primary and one duplicate sample were collected from sampling point RHMW2254-01 and from well OWDFMW01.

Analytical results from the Fourth Quarter 2016 groundwater monitoring event were compared to the current LTM screening criteria – criteria agreed upon by the Parties to the AOC and presented in the February 4, 2016, AOC Statement of Work Sections 6 and 7 scoping completion letter (EPA Region 9 and DOH 2016), and updated (where applicable) with the DOH Tier 1 Groundwater Environmental Action Levels (EALs) for sites where groundwater is a potential or current drinking water resource and the nearest surface water body is greater than 150 meters from release site. Analytical results for wells RHMW01, RHMW02, and RHMW03 were also compared to the Site-Specific Risk-Based Levels (SSRBLs) for total petroleum hydrocarbons (TPH)-diesel-range organics (TPH-d) (4,500 micrograms per liter [µg/L]) and benzene (750 µg/L), as established in the Red Hill *Groundwater Protection Plan* (GWPP) (DON 2014) and presented in the February 4, 2016, AOC Statement of Work Sections 6 and 7 scoping completion letter. A summary of the analytical results is provided in the following:

- 1 • *RHMW01*: The only analyte detected in groundwater was TPH-d (120 µg/L), which
2 exceeded the screening criterion (100 µg/L), but did not exceed the SSRBL (4,500 µg/L).
- 3 • *RHMW02*: Concentrations of TPH-d (1,300 µg/L), silica-gel-cleaned TPH-d (300 µg/L),
4 1-methylnaphthalene (25 µg/L), and naphthalene (49 µg/L) were detected exceeding their
5 respective screening criteria. The concentrations of TPH-d did not exceed the SSRBL of
6 4,500 µg/L. Concentrations of TPH-gasoline range organics (TPH-g) (35 µg/L) and
7 2-methylnaphthalene (9.2 µg/L) were also detected, but below their respective screening
8 criteria.
- 9 • *RHMW03*: The only analytes detected in groundwater were TPH-d (65 µg/L) and
10 TPH-residual range organics (TPH-o) (59 µg/L), both below the screening criteria.
- 11 • *OWDFMW01*: The only analytes detected in groundwater were TPH-d (54 µg/L for the
12 primary sample, and non-detect in the field duplicate) and TPH-o (110 µg/L for the primary
13 sample and non-detect in the duplicate). The concentration of TPH-o exceeded the screening
14 criterion.

15 The historical groundwater contaminant concentrations indicate a decline in chemical of potential
16 concern (COPC) concentrations since the 1st Quarter 2016 event.

17 The natural attenuation parameters (NAPs) also present evidence of anaerobic biodegradation
18 occurring at *RHMW02* at significant levels based on the depleted dissolved oxygen, very high
19 dissolved methane concentrations, the depleted sulfate concentrations, and the silica-gel-cleaned
20 TPH-d and TPH-o results. The concentrations of NAPs and silica-gel-cleaned TPH-d and TPH-o at
21 *RHMW01* and *RHMW02* also indicate that biodegradation (likely both aerobic and anaerobic) is
22 also occurring.

23 Based on the groundwater monitoring results and in accordance with the AOC Statement of Work
24 Sections 6 and 7, continued groundwater monitoring at the wells in the Red Hill groundwater
25 monitoring network is recommended.

26 Monthly sampling of the Red Hill monitoring network was initiated in November 2016 in response
27 to information obtained that the Red Hill Shaft pumps have been relatively inoperable since
28 February 2016 due to equipment (i.e., transformer) malfunction. Pumping at a reduced capacity was
29 initiated in November 2016 using temporary equipment, and the permanent equipment is scheduled
30 to be replaced late 2016 or early 2017, at which time pumping will return to normal capacity. To
31 evaluate potential impacts the changed pumping conditions may have on COPC concentrations in
32 groundwater at and around the Facility, monthly sampling was conducted in November and
33 December 2016. The next quarterly monitoring event is scheduled for January 2017, and then two
34 additional monthly events are planned in February and March 2017, followed by another quarterly
35 event in April 2017. It is anticipated that equipment repairs will have been completed by early 2017
36 and that only quarterly monitoring events will be conducted after the April 2017 sampling event.
37 Results of the monthly sampling events will be included in the scheduled quarterly monitoring
38 reports.

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ACRONYMS AND ABBREVIATIONS

1		
2	%	percent
3	—	no data
4	%R	percent recovery
5	µg/L	microgram per liter
6	AECOM	AECOM Technical Services, Inc.
7	AOC	Administrative Order on Consent
8	APPL	Agriculture and Priority Pollutants Laboratories, Inc.
9	bgs	below ground surface
10	BTEX	benzene, toluene, ethylbenzene, and xylenes
11	btoc	below top of casing
12	CLEAN	Comprehensive Long-Term Environmental Action Navy
13	CoC	chain-of-custody
14	COPC	chemical of potential concern
15	DL	detection limit
16	DLNR	Department of Land and Natural Resources, State of Hawai‘i
17	DO	dissolved oxygen
18	DoD	Department of Defense
19	DOH	Department of Health, State of Hawai‘i
20	DON; Navy	Department of the Navy, United States
21	EAL	Environmental Action Level
22	EPA	Environmental Protection Agency, United States
23	F-24	NATO-grade F-24 jet fuel
24	F-76	Marine Diesel Fuel
25	Facility	Red Hill Bulk Fuel Storage Facility
26	GW	groundwater
27	ft	foot/feet
28	GPS	global positioning system
29	GW	groundwater
30	GWPP	Groundwater Protection Plan
31	H.A.R.	Hawai‘i Administrative Rules
32	ID	identification
33	IDW	investigation-derived waste
34	JBPHH	Joint Base Pearl Harbor-Hickam
35	JP	Jet Fuel Propellant
36	JP-5	Jet Fuel Propellant No. 5
37	JP-8	Jet Fuel Propellant No. 8
38	LCS	laboratory control sample
39	LCSD	laboratory control sample duplicate
40	LOD	limit of detection
41	LOQ	limit of quantitation
42	LTM	long-term monitoring
43	MDL	method detection limit
44	mg/L	milligram per liter
45	MS	matrix spike
46	MSD	matrix spike duplicate
47	msl	mean sea level

1	mV	millivolt
2	NAP	natural attenuation parameter
3	NAPL	non-aqueous phase liquid
4	NATO	North Atlantic Treaty Organization
5	NAVFAC	Naval Facilities Engineering Command
6	NAVSUP FLC	Naval Supply Systems Command Fleet Logistics Center
7	ORP	oxidation reduction potential
8	PAH	polynuclear aromatic hydrocarbon
9	PARCCS	precision, accuracy, representativeness, completeness, comparability, and
10		sensitivity
11	pH	hydrogen activity
12	PID	photoionization detector
13	ppm	part per million
14	QA	quality assurance
15	QC	quality control
16	Qtr	quarter
17	QSM	quality systems manual
18	RPD	relative percent difference
19	Rpt	report
20	SAP	sampling and analysis plan
21	SOW	Scope of Work
22	SSRBL	Site-Specific Risk-Based Level
23	TGM	Technical Guidance Manual
24	THQ	target hazard quotient
25	TPH	total petroleum hydrocarbons
26	TPH-d	total petroleum hydrocarbons-diesel range organics
27	TPH-g	total petroleum hydrocarbons-gasoline range organics
28	TPH-o	total petroleum hydrocarbons-residual range organics (i.e., TPH-oil)
29	U.S.	United States
30	UST	underground storage tank
31	VOA	volatile organic analyte
32	VOC	volatile organic compound
33	WP	work plan